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NATIONAL DAM SAFETY PROGRAM. LAKE JEANO DAM (MO 30018), MISSISS--ETC(U)
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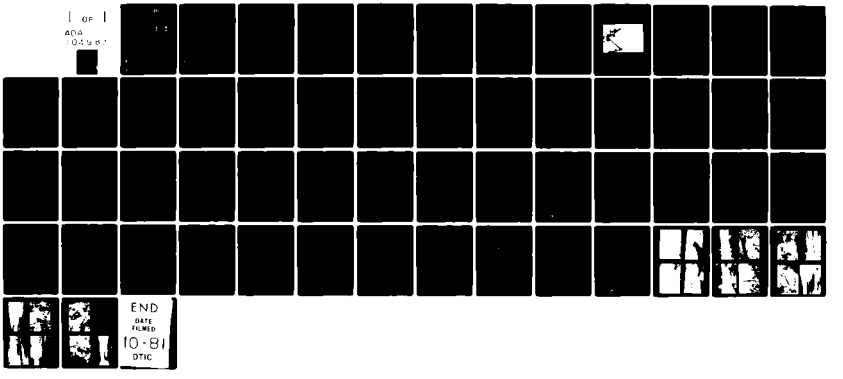

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LAKE JEANO DAM

WAYNE COUNTY, MISSOURI

MO 30018

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1979

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Lake Jeano Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Lake Jeano dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division — 31 MAR 1980 Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer — 1 APR 1980 Date

LAKE JEANO DAM

WAYNE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30018

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared By

Anderson Engineering, Inc., Springfield, Missouri
Hanson Engineers, Inc., Springfield, Illinois

Under Direction Of

St. Louis District, Corps of Engineers

For

Governor of Missouri

March 1980

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Lake Jeano Dam
State Located:	Missouri
County Located:	Wayne
Stream:	Greasy Creek
Date of Inspection:	August 23, 1979

Lake Jeano Dam was inspected by an interdisciplinary team of engineers from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, the St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur if the dam fails. The estimated damage zone extends approximately one mile downstream of the dam. Located within this zone are several dwellings and three buildings. The dam is in the small size classification, since maximum storage capacity is greater than 50 ac-ft but less than 1000 ac-ft.

Our inspection and evaluation indicates that the combined spillways do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The combined spillways will pass 9 percent of the Probable Maximum Flood without overtopping. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The guidelines require that a dam of small size with a high downstream hazard potential pass 50 to 100 percent of the PMF. Considering the small size of the dam, the low storage capacity of the reservoir and the large floodplain downstream, 50 percent of the PMF has been determined to be the appropriate spillway design flood. The 100-year frequency flood will overtop the dam. The 100-

year flood is one that has a 1 percent chance of being equaled or exceeded in any given year. The combined spillways will pass the 10-year frequency flood.

Deficiencies visually observed by the inspection team were: (1) overgrowth of brush, weeds and small trees on the embankment; (2) poor condition of the trash rack (wire mesh) and primary spillway riser pipe; (3) debris, brush and weeds near the primary spillway entrance; (4) link fence and fish tank obstructing the control section and outlet channel of the emergency spillway; (5) erosion at the abutment-dam contacts; (6) seepage at the primary spillway outlet and possible seepage at the downstream toe of dam at Stations 2+75 and 4+00; and (7) brush and trees in the primary spillway outlet channel. Another deficiency was the lack of seepage and stability analysis records.

It is recommended that the owners take the necessary action in the near future to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.

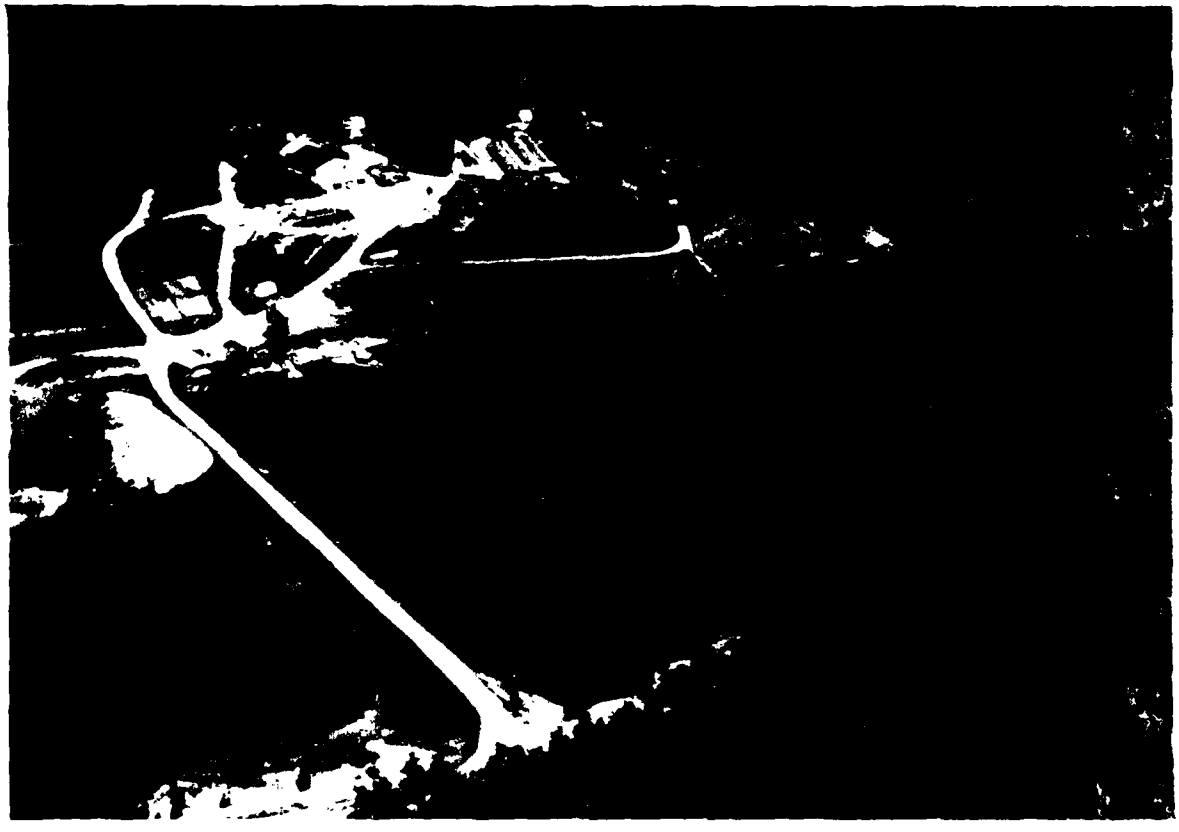
Jack Healy, P.E., (HEI)

Steve Brady, P.E. (AEI)

Gene Wertepny, P.E. (HEI)

Tom Beckley, P.E. (AEI)

Dan Kerns, E.I.T. (HEI)



AERIAL VIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE JEANO DAM - ID No. 30018

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APPENDICES

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

A. Authority:

The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Lake Jeano Dam in Wayne County, Missouri.

B. Purpose of Inspection:

The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and a visual inspection in order to determine if the dam poses hazards to human life or property.

C. Evaluation Criteria:

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, "Recommended Guidelines for Safety Inspection of Dams, Appendix D." These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT:

A. Description of Dam and Appurtenances:

Lake Jeano Dam is an earth fill structure approximately 23 ft high and 450 ft long at the crest. The appurtenant works consist of a drop inlet primary spillway (24 in. diameter CMP riser and 18 in. diameter CMP outlet) and a trapezoidal channel (16 ft bottom width) emergency spillway. Sheet 3 of Appendix A shows a plan profile and typical section of the embankment.

B. Location:

The dam is located in the northwest part of Wayne County, Missouri on Greasy Creek. The dam and lake are

within the Piedmont, Missouri 7.5 minute quadrangle sheet (Section 2, T29N, R3E - latitude 37° 12.8'; longitude 90° 41.2'). Sheet 2 of Appendix A shows the general vicinity.

C. Size Classification:

With an embankment height of 23 ft and a maximum storage capacity of approximately 146 acre-ft, the dam is in the small size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has classified this dam as a high hazard dam. The estimated damage zone extends approximately one mile downstream of the dam. Located within this zone are several dwellings and three buildings.

E. Ownership:

The dam is owned by C. A. Ricketts. The owner's address is Route 2, Box 85, Piedmont, Missouri 63957 (telephone 314-223-7363).

F. Purpose of Dam:

The dam was constructed primarily for recreational purposes, although some flood protection is also provided.

G. Design and Construction History:

No design information is available. The dam was constructed in 1964 by Mr. Glen Dover (deceased). The present owner, who purchased the dam in 1965, indicated that he believed that a government agency was involved in the construction of the dam. However, the local Soil Conservation Service office has no record of any assistance provided concerning the dam's construction. Excavated material from the basement area of the owner's house was recently placed on the downstream face of the dam near the west end and in the emergency spillway channel to repair areas damaged by erosion.

H. Normal Operating Procedures:

All flows are discharged through uncontrolled spillways. There is no regulating facility associated with this dam. The owner said that the dam has never been overtopped

since he bought it in 1965, but the emergency spillway has been used several times.

1.3 PERTINENT DATA:

Pertinent data about the dam, appurtenant works, and reservoir are presented in the following paragraphs. Sheet 3 of Appendix A presents a plan, profile and typical section of the embankment.

A. Drainage Area:

The drainage area for this dam, as obtained from the U.S.G.S. quad sheet, is approximately 562 acres.

B. Discharge at Dam Site:

(1) All discharge at the dam site is through uncontrolled spillways.

(2) Estimated Total Spillway Capacity at Maximum Pool (Top of Dam - El. 723.5): 283 cfs

(3) Estimated Capacity of Primary Spillway: 23 cfs

(4) Estimated Experienced Maximum Flood at Dam Site: Unknown

(5) Diversion Tunnel Low Pool Outlet at Pool Elevation: Not Applicable

(6) Diversion Tunnel Outlet at Pool Elevation: Not Applicable

(7) Gated Spillway Capacity at Pool Elevation: Not Applicable

(8) Gated Spillway Capacity at Maximum Pool Elevation: Not Applicable

C. Elevations:

All elevations are consistent with an estimated M.S.L. elevation of 719.6 for the primary spillway crest (see Sheet 3, Appendix A).

(1) Top of Dam: 723.5 (lowest point)

(2) Principal Spillway Crest: 719.6

(3) Emergency Spillway Crest: 721.2

(4) Principal Outlet Pipe Invert: 704.5

(5) Streambed at Centerline of Dam: 702.0

(6) Pool on Date of Inspection: 719.3

(7) Apparent High Water Mark: Unknown

(8) Maximum Tailwater: Unknown

(9) Upstream Portal Invert Diversion Tunnel: Not Applicable

(10) Downstream Portal Invert Diversion Tunnel: Not Applicable

D. Reservoir Lengths:

(1) At Top of Dam: 1665 ft

(2) At Principal Spillway Crest: 1350 ft

(3) At Emergency Spillway Crest: 1480 ft

E. Storage Capacities:

(1) At Principal Spillway Crest: 81 ac-ft

(2) At Top of Dam: 146 ac-ft

(3) At Emergency Spillway Crest: 107 ac-ft

F. Reservoir Surface Areas:

(1) At Principal Spillway Crest: 13.8 acres

(2) At Top of Dam: 19.5 acres

(3) At Emergency Spillway Crest: 16.1 acres

G. Dam:

(1) Type: Earth

(2) Length at Crest: 450 ft

(3) Height: 23 ft

(4) Top Width: 14 ft

(5) Side Slopes: Upstream Varies; Downstream Varies (see Sheet 3 of Appendix A)

(6) Zoning: Unknown

(7) Impervious Core: Unknown

(8) Cutoff: Unknown

(9) Grout Curtain: Unknown

H. Diversion and Regulating Tunnel:

(1) Type: Not Applicable

(2) Length: Not Applicable

(3) Closure: Not Applicable

(4) Access: Not Applicable

(5) Regulating Facilities: Not Applicable

I. Spillway:

I.1 Principal Spillway:

(1) Location: East Abutment

(2) Type: Drop Inlet Pipe

I.2 Emergency Spillway:

(1) Location: West Abutment

(2) Type: Earth Trapezoidal Channel

J. Regulating Outlets:

There are no regulating or dewatering facilities associated with this dam.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No design computations or reports for Lake Jeano Dam were available. No documentations of construction inspection records were obtained. To our knowledge, there are no documented maintenance data.

A. Surveys:

No information regarding pre-construction surveys could be obtained. Sheet 3 of Appendix A presents a plan, profile and cross section of the dam from survey data obtained during the site inspection. The top of the 24 in. riser of the primary spillway was used as a reference point to determine the other elevations. This reference point corresponds to an approximate M.S.L. elevation of 719.6 ft as derived from a U.S.G.S. quadrangle map and our survey notes.

B. Geology and Subsurface Materials:

The site is located at the western limits of the St. Francois Mountains geologic region of Missouri. The St. Francois Mountains are described as an island of crystalline rocks entirely surrounded by the Salem Plateau. The area is characterized topographically by steep mountains of Precambrian age. These mountains are highly resistant to erosion as compared with the once-overlying Paleozoic formations. These igneous mountains are encircled by dolomite, sandstone and chert of the Cambrian system.

Information from the Missouri Department of Natural Resources indicates that the bedrock in the area is the Eminence Dolomite, which is a massive, densely-jointed formation having considerable permeability. Large springs as well as many major caves are developed in the Eminence. The publication "Caves of Missouri" lists three caves known to exist in Wayne County, the closest being about six miles east of the site. Of two caves listed in adjacent Reynolds County, the closest is about eleven miles northwest of the site. No caves are listed in adjacent Iron and Madison Counties.

Information from the United States Department of Agriculture Soil Conservation Service indicates that the soils in the immediate area of the dam and lake consist primary of Clarksville Stony Silt Loam. The Clarksville series subsoil

is a reddish-yellow to red silty clay to heavy, stiff, tenacious, compact clay. These residual soils are derived from cherty and dolomitic limestones. Chert fragments are very common in the Clarksville soils. The loessial thickness map indicates that upland areas may have about 2.5 ft of loess cover.

C. Foundation and Embankment Design:

No foundation and embankment design information was available. Seepage and stability analyses apparently were not performed as required in the guidelines. There is apparently no particular zoning of the embankment, and no internal drainage features are known to exist. No construction inspection test results have been obtained.

D. Hydrology and Hydraulics:

No hydrologic or hydraulic design computations for Lake Jeano Dam are available. Based on the field dimensions of the spillways, embankment elevations and the watershed and lake areas obtained by planimeter from the U.S.G.S. quad maps, hydrologic analyses using the U.S. Corps of Engineers guidelines were performed and appear in Appendix C, Sheets 1 to 8. It was concluded that the structure will pass 9 percent of the Probable Maximum Flood without overtopping. The 100-year frequency flood will overtop the dam.

E. Structure:

The appurtenant structures associated with this dam include a drop inlet primary spillway (24 in. diameter CMP riser and 18 in. diameter CMP outlet) and a trapezoidal channel (16 ft bottom width) emergency spillway.

2.2 CONSTRUCTION:

No construction inspection data were obtained.

2.3 OPERATION:

Normal flows are discharged through the uncontrolled primary and emergency spillways. There are no regulating facilities associated with this dam, and therefore, no operating records are known to exist. The overgrowth of brush, weeds and small trees on the embankment and the condition of the spillway riser entrance (partially clogged with debris and also badly rusted) indicate that the dam has not been maintained in recent years.

2.4 EVALUATION:

A. Availability:

No engineering data, seepage or stability analyses, or construction test data were available.

B. Adequacy:

The engineering data available were inadequate to make a detailed assessment of the design, construction, and operation of this structure. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

C. Validity:

To our knowledge, no valid engineering data on the design or construction of the embankment are available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

A. General:

The field inspection was made on August 23, 1979. The inspection team consisted of personnel from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The team members were:

Steve Brady - Anderson Engineering (Civil Engineer)
Tom Beckley - Anderson Engineering (Civil Engineer)
Jack Healy - Hanson Engineers, Inc. (Geotechnical and Structural Engineer)
Gene Wertepny - Hanson Engineers, Inc. (Hydraulic Engineer)
Dan Kerns - Hanson Engineers, Inc. (Geotechnical Engineer)

B. Dam:

The dam appears to be generally in good condition. Considerable tree and brush growth was noted on the embankment faces. The wire mesh trash rack around the primary spillway inlet was in disrepair. The primary spillway riser tube was partially blocked by debris and was rusted so that water was flowing into the tube despite the fact that the lake level was several inches below the crest of the spillway. A chain link fence and concrete fish holding tank were present in the emergency spillway channel. The vertical and horizontal alignments of the crest appeared good, although the crest slopes slightly downward to the west. No surface cracking or unusual movement was obvious. Shallow auger probes into the embankment indicated the dam to be constructed of a brownish red silty clay with rock fragments. Some riprap was observed on the upstream embankment face, and no sloughing or erosion was noted. Some minor erosion was observed at the abutment-dam contacts.

Seepage (estimated at about .5 gallons per minute) was observed around the primary spillway outlet and from the side of the plunge pool (see Photo Nos. 16 and 17). Possible seepage areas were observed at the downstream toe of the embankment at Stations 2+75 and 4+00. Although no noticeable seepage flows were observed, these areas were soft and wet, and some iron oxide staining was noted (see Photo No. 18). The primary spillway outlet channel contains a significant amount of brush and tree growth (see Photo No. 10).

C. Appurtenant Structures:

C.1 Primary Spillway:

The entrance to the primary spillway was partially clogged with debris. The riser pipe is very rusted, and the trash rack (wire mesh) is in poor condition (see Photo Nos. 6 and 7). The area around the trash rack is full of debris, woods and heavy brush.

C.2 Emergency Spillway:

A 6 ft high chain link fence extends partially into the emergency spillway channel near the control section. Also, a fish tank is built in the right side slope of the control section (see Photo No. 12). The approach and outlet channels appear to be in good condition, although some erosion has occurred in the outlet channel. The outlet channel is separated from the embankment, and spillway discharges would not be expected to endanger the embankment. Erosion in the spillway section was repaired this year.

D. Reservoir:

The watershed is generally wooded and grassy, with no agricultural activity. The slopes adjacent to the lake are moderate and rolling and no sloughing or serious erosion was noted.

E. Downstream Channel:

The primary spillway outlet channel contains brush and tree growth. The emergency spillway outlet channel is clear with a few scattered trees and brush noted.

3.2 EVALUATION:

Trees and brush on the dam present a potential seepage hazard and encourage animal burrowing. Debris near the primary spillway inlet and brush and tree growth in the primary spillway outlet channel can restrict flood flows. In addition, the chain link fence and fish holding tank restrict flows over the emergency spillway. The rusted condition of the primary spillway riser is apparently causing a lowering of the normal pool of the lake.

The seepage at the primary spillway outlet and downstream toe of the dam should be investigated by an engineer experienced in the design and construction of dams. The erosion at the abutment-dam contacts could worsen and adversely affect the stability of the dam.

These deficiencies should be corrected under the direction of an engineer experienced in the design and construction of dams.

Photographs of the dam, appurtenant structures, and the reservoir are presented in Appendix D.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

There are no controlled outlet works for this dam. The primary and emergency spillways are uncontrolled, so that the pool is normally controlled by rainfall, runoff, evaporation and seepage.

4.2 MAINTENANCE OF DAM:

The overgrowth of brush, weeds and small trees on the embankment and the condition of the primary spillway entrance indicate that the dam has not been maintained in the recent years.

4.3 MAINTENANCE OF OPERATING FACILITIES:

There are no operating facilities for this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

The inspection team is unaware of any existing warning system for this dam.

4.5 EVALUATION:

The trees and brush on the embankment, deteriorated condition of the primary spillway riser pipe, debris at the entrance to the primary spillway, obstructions in the emergency spillway channel, seepage at the primary spillway outlet and the downstream toe of the dam, brush and trees in the primary spillway outlet channel, and minor erosion at the abutment-dam contacts are serious deficiencies which should be corrected. However, to aboid creating an unsafe condition these should only be accomplished under the direction of an engineer experienced in the design and construction of dams.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. & B. Design and Experience Data:

The hydraulic and hydrologic analyses were based on: (1) a field survey of spillway dimensions and embankment elevations; and (2) an estimate of the pool and drainage areas from the U.S.G.S. quad sheet. The owner indicated that although the dam has never overtopped, the emergency spillway has operated several times. Our hydrologic and hydraulic analyses using U. S. Army Corps of Engineers guidelines appear in Appendix C.

C. Visual Observations:

The debris at the entrance of the primary spillway reduces the discharge capacity of the outlet pipe. The poor condition of the trash rack (wire mesh) will not prevent the entrance of debris into the primary spillway.

The chain link fence and the fish tank near the control section of the emergency spillway reduce the discharge capacity of the spillway.

D. Overtopping Potential:

Based on the hydrologic and hydraulic analyses presented in Appendix C, the combined spillways will pass 9 percent of the Probable Maximum Flood. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief of Engineers, require that this structure (small size with high downstream hazard potential) pass 50 percent to 100 percent of the PMF, without overtopping. Considering the small size of the dam, the low storage impoundment capacity of the reservoir and the large floodplain downstream, 50 percent of the PMF has been determined to be the appropriate spillway design flood. The structure will not pass a 100-year frequency flood without overtopping, but will pass the 10 year frequency flood at elevation 722.60 with 0.90 ft of freeboard.

The routing of 50 percent of the PMF through the spillways and dam indicates that the dam will be overtopped by

2.33 ft at elevation 725.83. The duration of the overtopping will be 6.83 hours, and the maximum outflow will be 4875 cfs. The maximum discharge capacity of the spillways is 283 cfs. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure. Although the silty clay material which comprises the embankment is not considered highly erodible, significant damage or failure would be expected, considering the height and duration of overtopping that would result from the design flood.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. *Visual Observations*:

Observed features which could adversely affect the structural stability of this dam are discussed in Sections 3.1B and 3.2.

B. Design and Construction Data:

No design and construction data for the foundation and the embankment were available. Seepage and stability analyses comparable to the requirements of the guidelines were not available, which constitutes a deficiency which should be rectified.

C. Operating Records:

No operating records have been obtained.

D. Post-Construction Changes:

The embankment was constructed in 1963. To our knowledge, the only post-construction change involved recently placing excavated material from the basement of the owner's house on the downstream face of the dam near the west end and repairing eroded areas of the emergency spillway discharge channel.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in stability analyses performed for this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

This Phase I inspection and evaluation should not be considered as being comprehensive since the scope of work contracted for is far less detailed than would be required for an in-depth evaluation of dams. Latent deficiencies, which might be detected by a totally comprehensive investigation, could exist.

A. Safety:

The embankment is generally in good condition. Several items were noted during the visual inspection which should be investigated further, corrected or controlled. These items are: (1) overgrowth of brush, weeds and small trees on the embankment; (2) poor condition of the trash rack (wire mesh) and primary spillway riser pipe; (3) debris, brush and weeds near the primary spillway entrance; (4) chain link fence and fish tank obstructing the control section and outlet channel of the emergency spillway; (5) minor erosion of the abutment-dam contacts; (6) seepage at the primary spillway outlet and possible seepage at the downstream embankment toe at Stations 2+75 and 4+00; and (7) brush and trees in the primary spillway outlet channel.

Another deficiency is the lack of seepage and stability analysis records.

The dam will be overtopped by flows in excess of 9 percent of the Probable Maximum Flood. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

B. Adequacy of Information:

The conclusions in this report were based on the performance history as related by others, and visual observation of external conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

C. Urgency:

The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the deficiencies listed in paragraph A are not corrected, and if good

maintenance is not provided, the embankment condition will deteriorate and possibly could become serious in the future. The item recommended in paragraph 7.2A should be pursued on a high priority basis.

D. Necessity for Phase II:

Based on the result of the Phase I inspection, no Phase II inspection is recommended.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES:

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

A. Alternatives:

(1) Spillway size and/or height of dam should be increased to pass 50 percent of the PMF. In either case, the spillway should be protected to prevent erosion.

B. O&M Procedures:

(1) Seepage and stability analyses comparable to the requirements of the recommended guidelines should be performed by an engineer experienced in the construction of dams.

(2) Brush and tree growth should be removed from the dam and from the primary spillway outlet channel. This should be done under the guidance of a professional engineer experienced in the design and construction of dams. Indiscriminate clearing methods could jeopardize the safety of the dam. Brush and tree growth should then be removed from the dam on an annual basis.

(3) The seepage at the primary spillway outlet and at the downstream toe of the dam should be investigated by an engineer experienced in the design and construction of dams. Remedial measures may be required. As a minimum, this seepage should be channelized and monitored to determine if there is any increase in quantities and whether soil particles are being carried with the water.

(4) Erosional areas as previously discussed should be repaired and maintained.

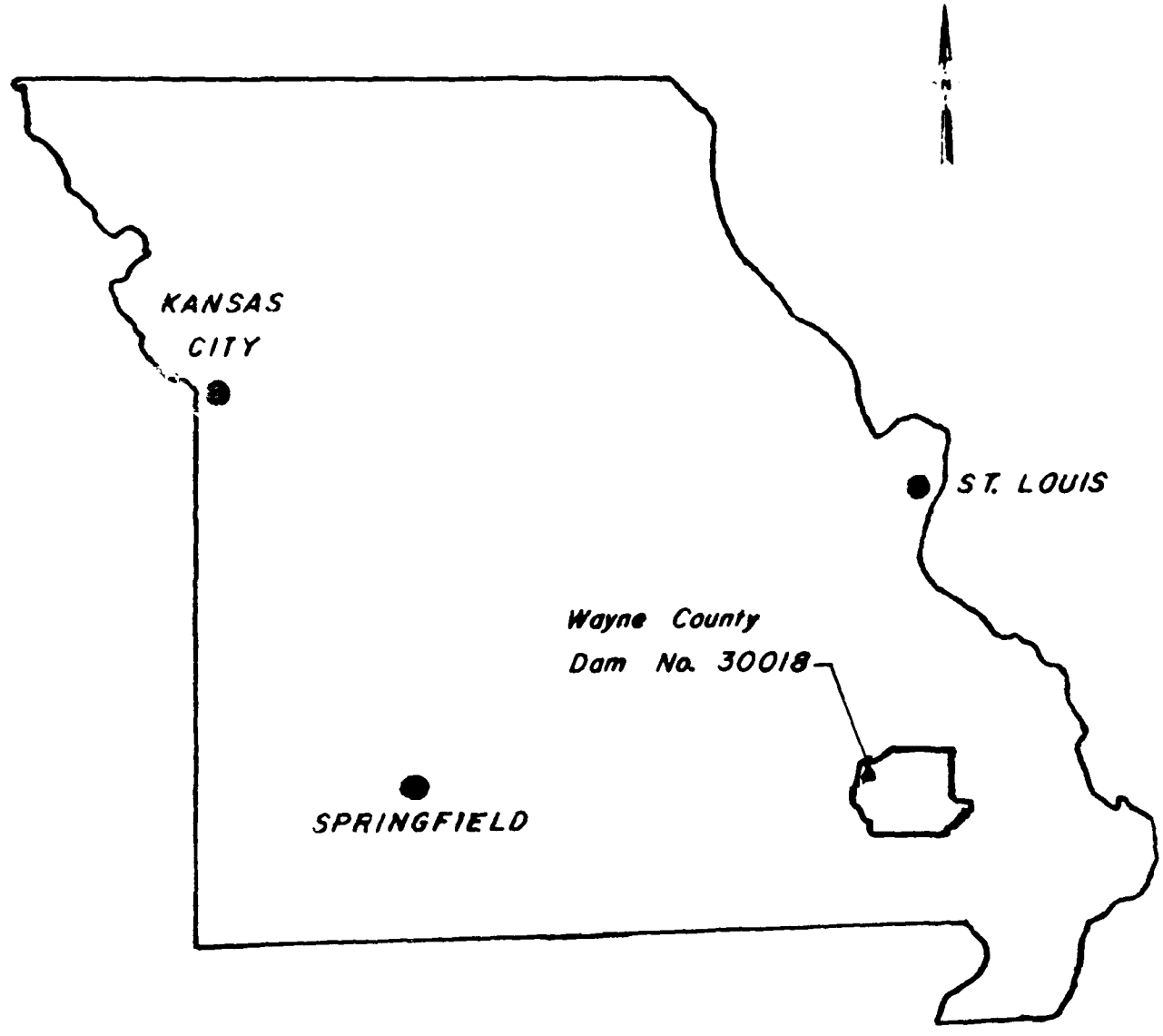
(5) The trash rack should be repaired to prevent debris from entering and possibly plugging primary spillway pipe.

(6) The primary spillway inlet pipe should be repaired to maintain the normal pool level of the lake.

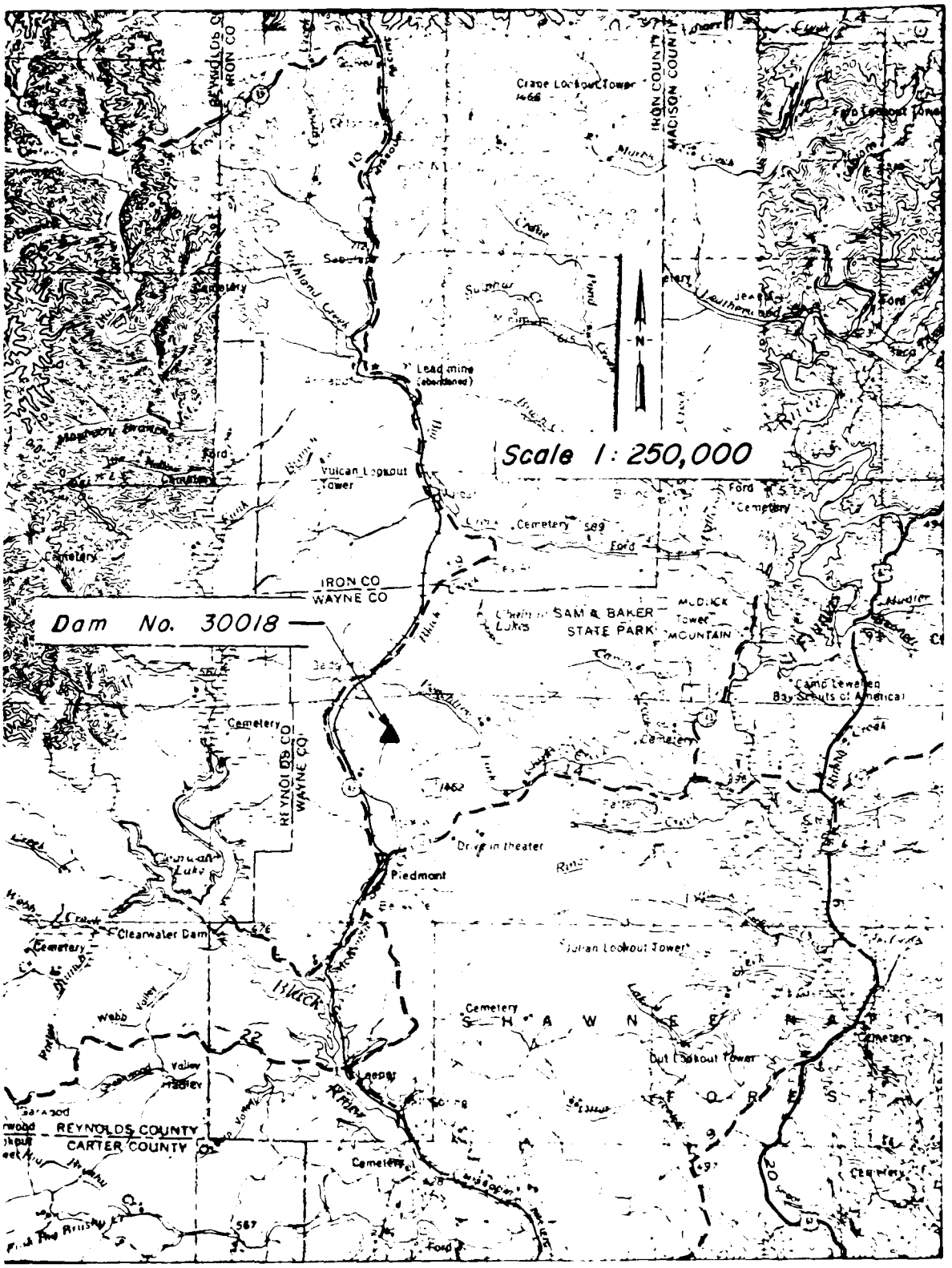
(7) The chain link fence and holding tank should be removed from the emergency spillway area.

(8) A detailed inspection of the dam should be made periodically by an engineer experienced in the design and construction of dams.

APPENDIX A

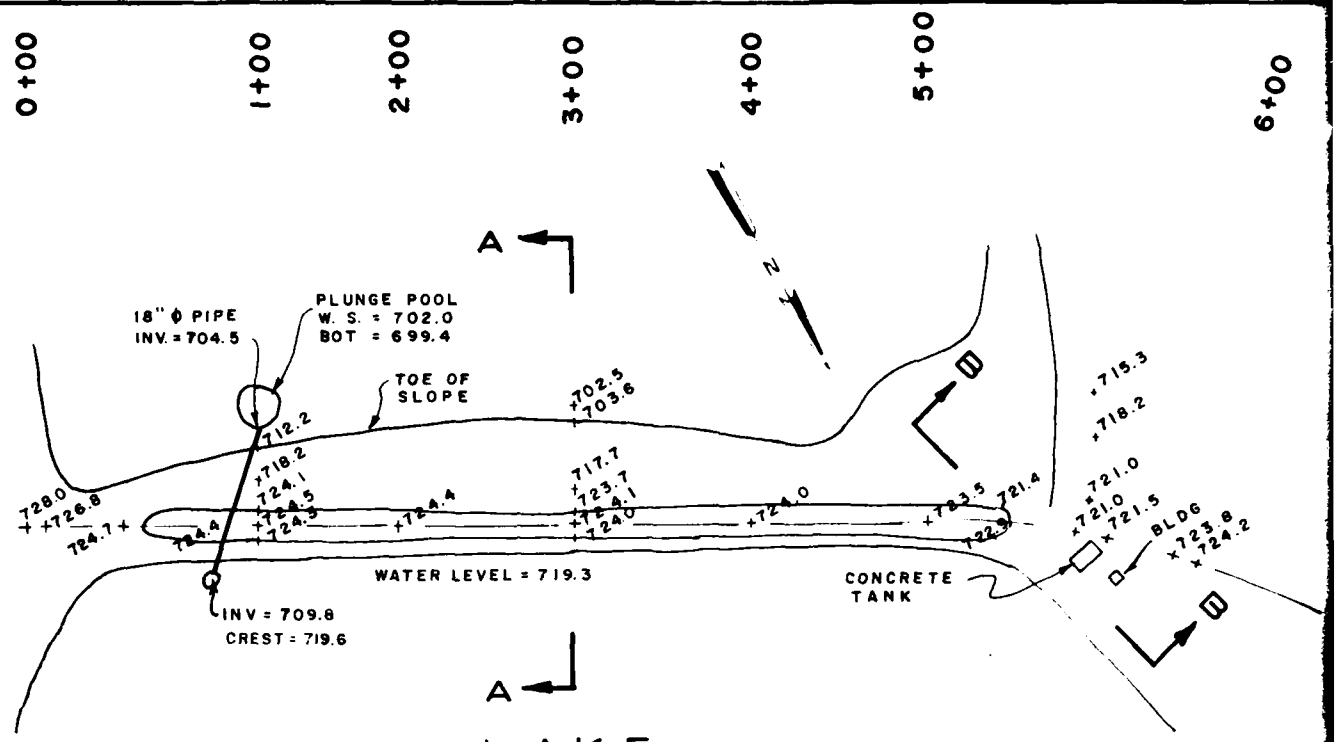


LOCATION MAP



SITE VICINITY MAP

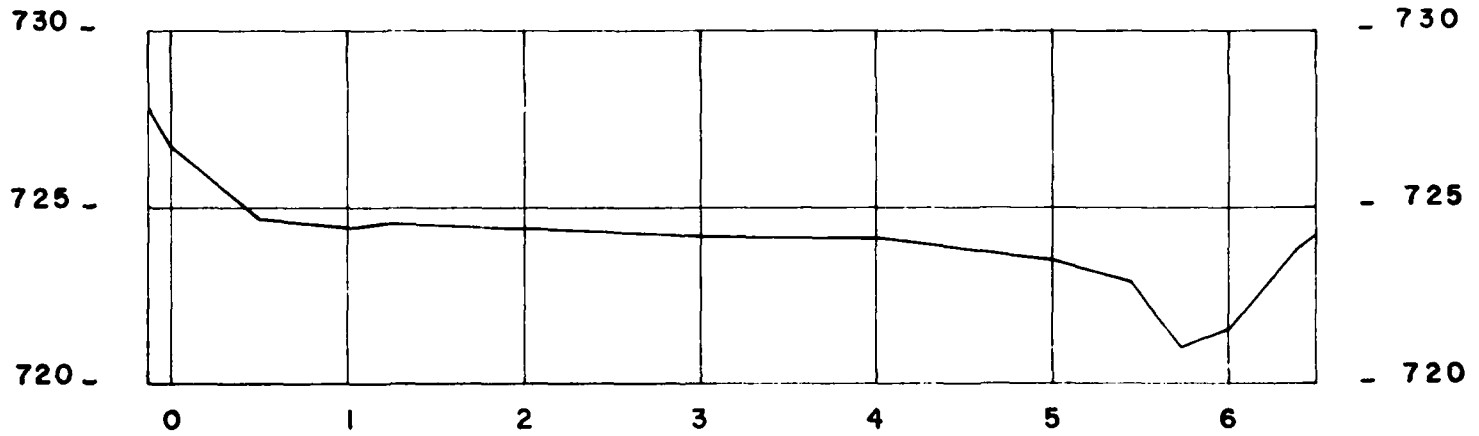
Sheet 2 Appendix A



BENCHMARK:
TOP OF 24 INCH DIAMETER RISER
ELEV. 719.6 MSL

PLAN VIEW

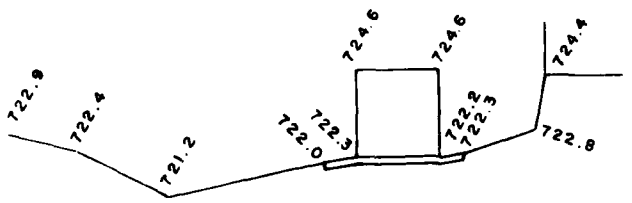
SCALE: 1" = 100'



PROFILE

6400

5+45



725

720

WATER LEVEL
719 3
717.8

LD6
723.8
724.2

0 20 40 60

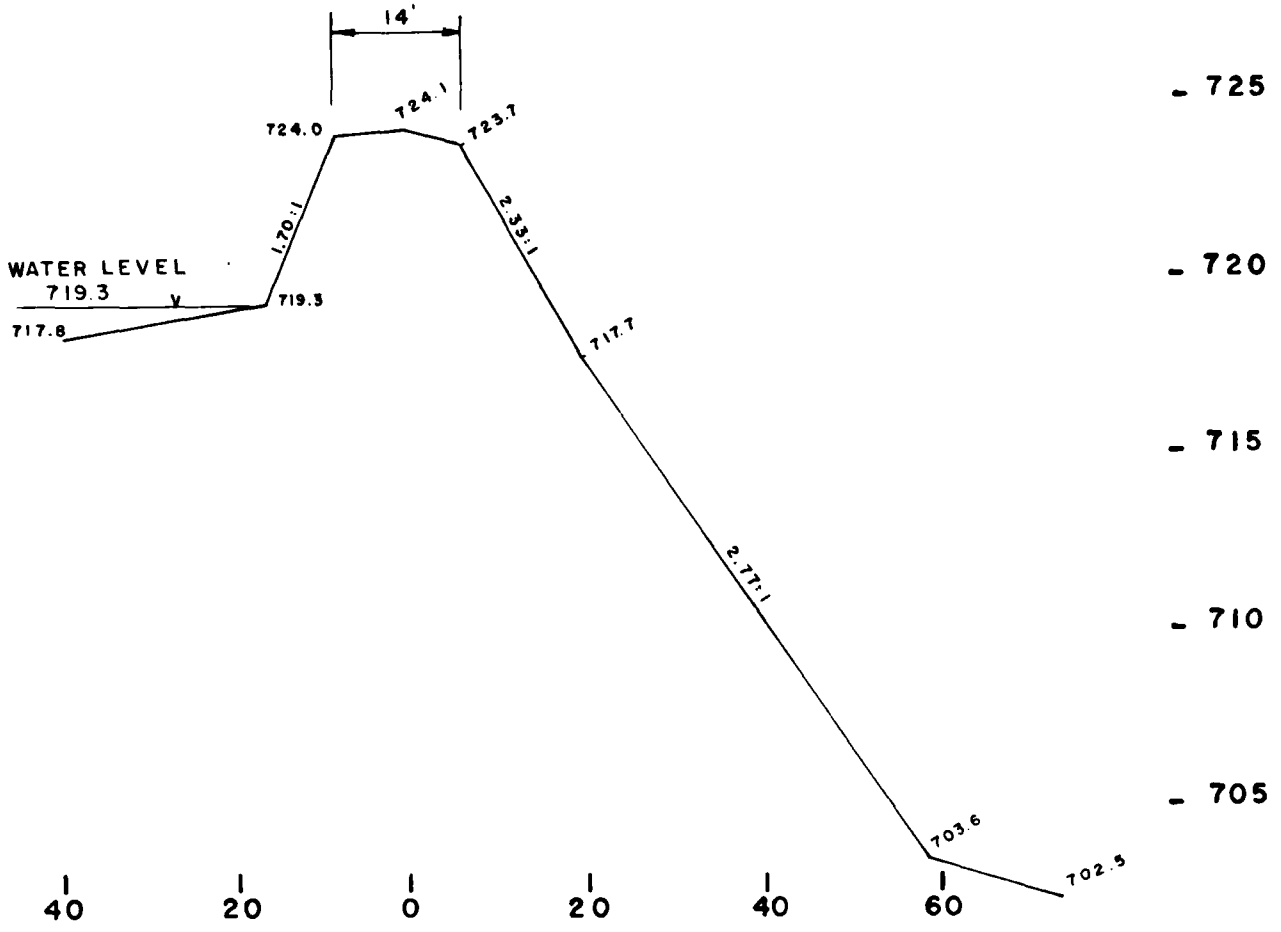
SECTION B-B

40 20

730

725

720



SECTION A-A STA 3+00

Sheet 3 of Appendix A

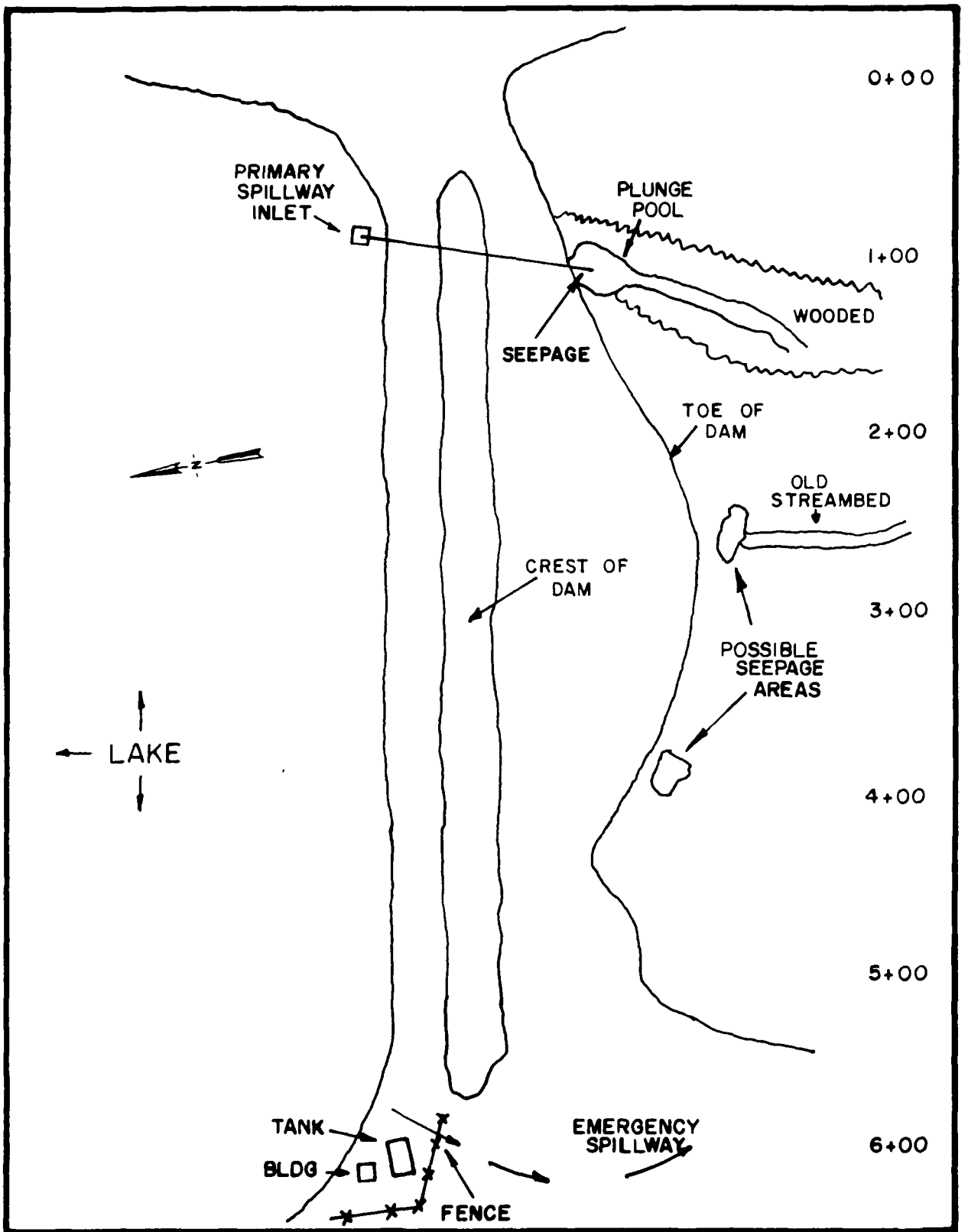
'ANDERSON ENGINEERING, INC.
730 NORTH BENTON AVENUE
SPRINGFIELD, MISSOURI 65802

LAKE JEANO DAM

MO. No. 30018

PLAN & PROFILE

WAYNE COUNTY, MO.



PLAN SKETCH

HANSON ENGINEERS

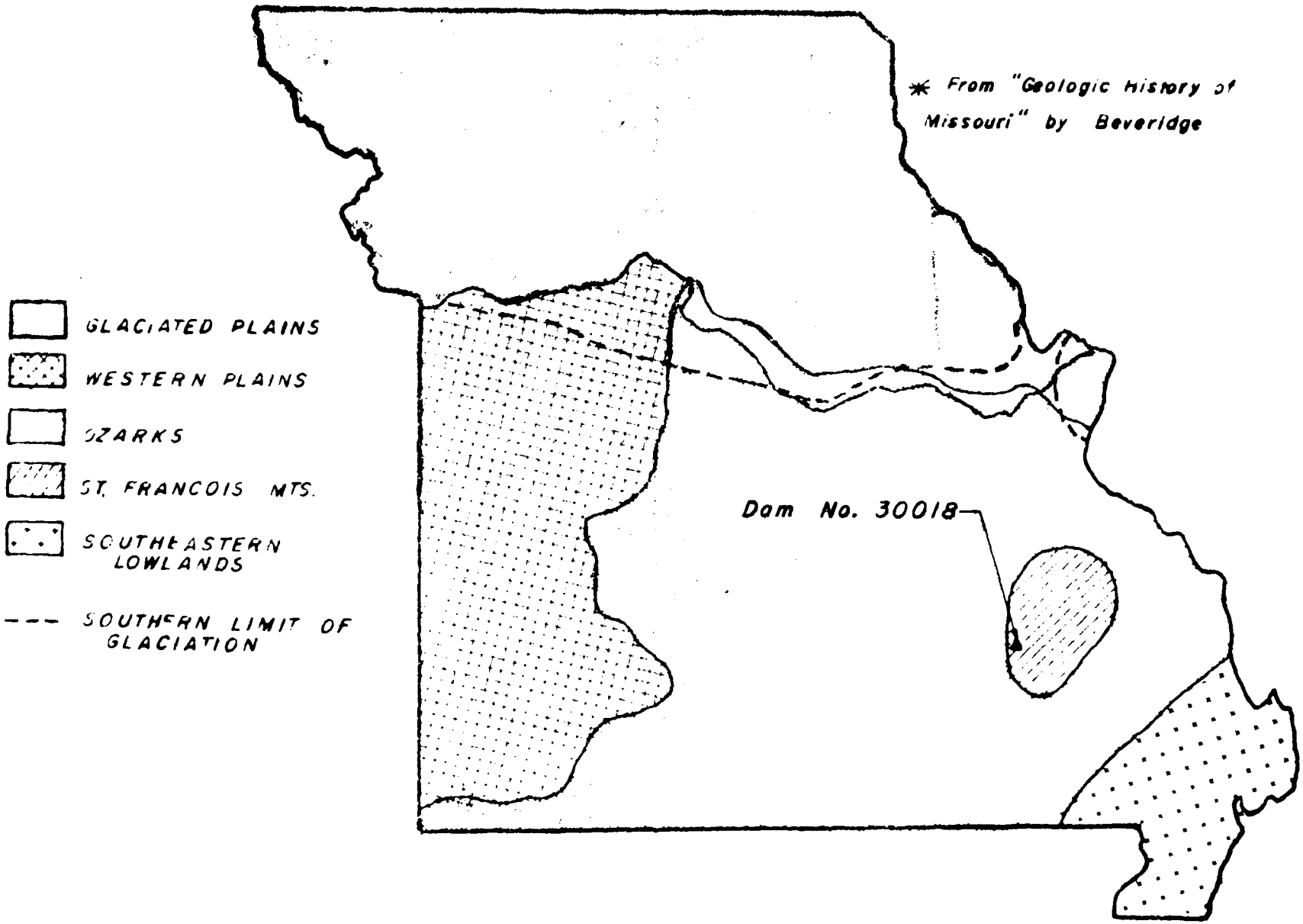
SPRINGFIELD ILL. PEORIA ILL.

LAKE JEANO DAM
MO. I.D. NO. 30018

SHEET 4 APPENDIX A

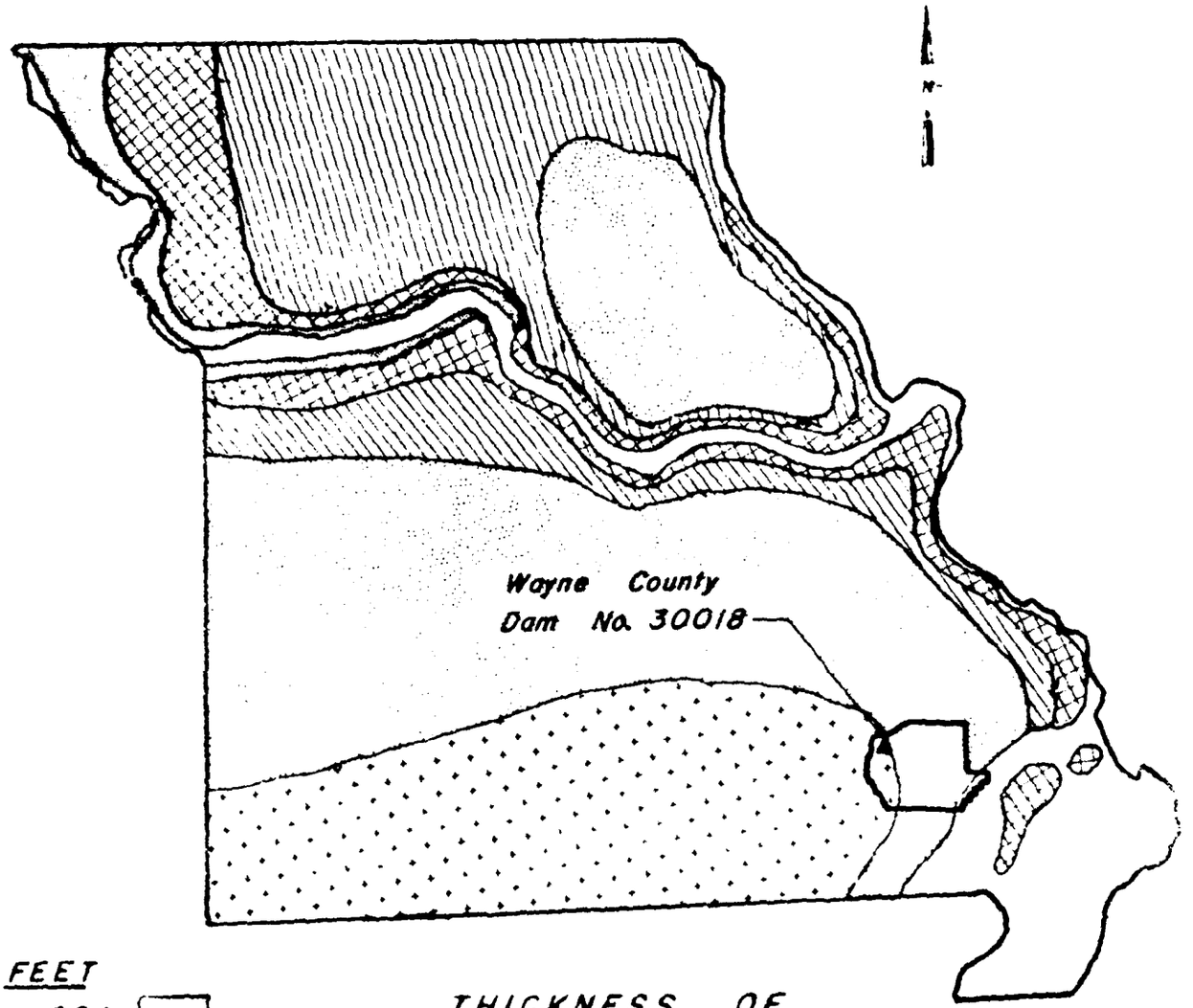
APPENDIX B

MAJOR GEOLOGIC REGIONS OF MISSOURI



* From "Geologic History of Missouri" by Beveridge

* From "Soils of Missouri"



FEET

20+

10-20

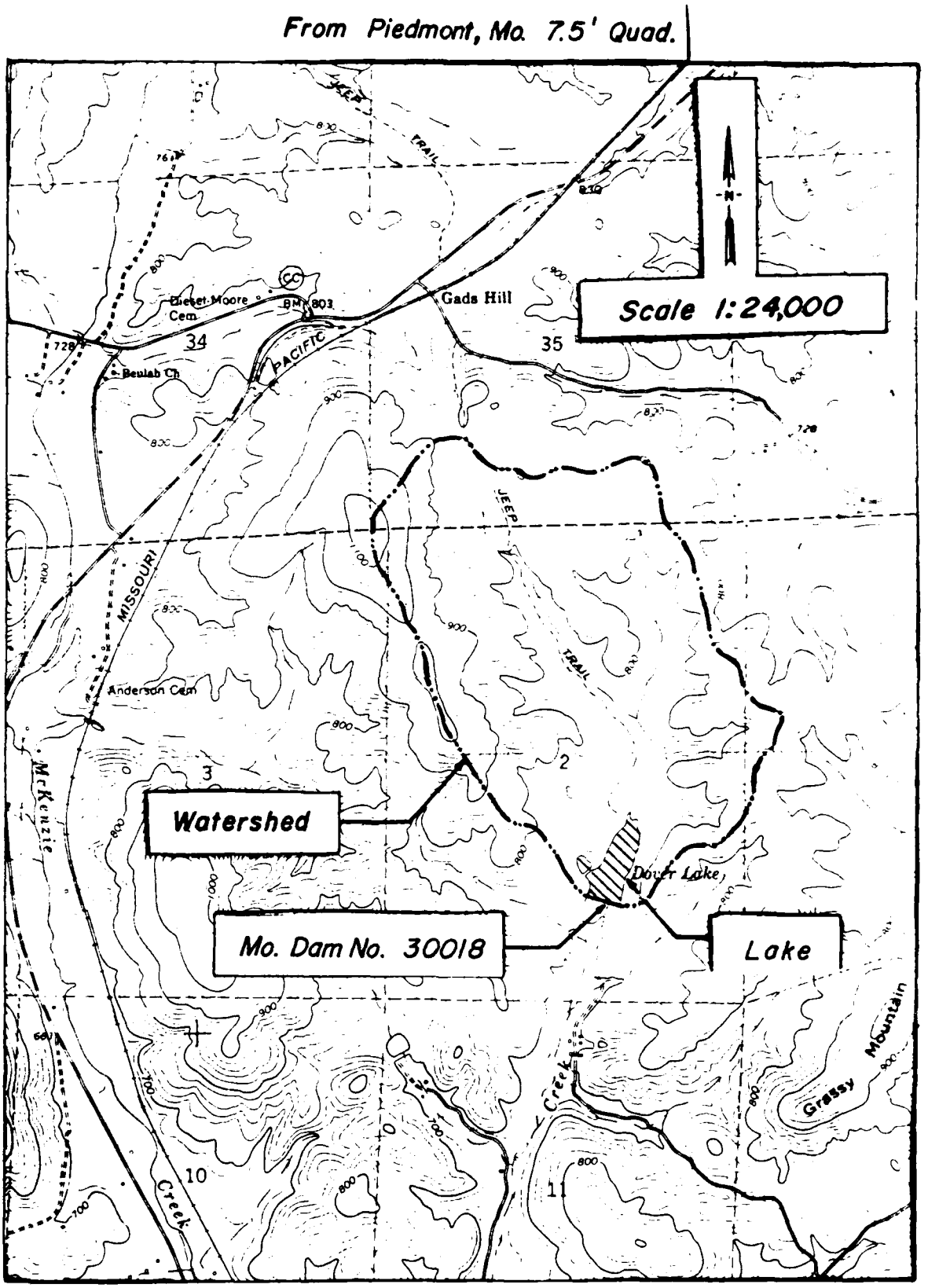
5-10

2.5-5

2.5-

THICKNESS OF LOESSIAL DEPOSITS

APPENDIX C



LAKE AND WATERSHED MAP

Sheet 1 Appendix C

HYDRAULIC AND HYDROLOGIC DATA

Design Data: From Field Measurements and Computations

Experience Data: No records are available. The owner indicated that the dam had never overtopped, although the emergency spillway has operated several times in recent years.

Visual Inspection: At the time of the inspection, the pool level was approximately 0.3 ft below normal pool.

Overtopping Potential: Flood routings were performed to determine the overtopping potential. The watershed and the reservoir surface areas were obtained by planimeter from the U.S.G.S. Piedmont, Missouri 7.5 minute quadrangle map. The storage volume was developed from these data. A 5 minute interval unit hydrograph was developed for this watershed, which resulted in a peak inflow of 1775 c.f.s. and a time to peak of 14 minutes. Application of the probable maximum precipitation minus losses results in a flood hydrograph peak inflow of 10,588 c.f.s. Rainfall distribution for the 24 hour storm was according to EM 1110-2-1411.

Based on our analyses, the combined spillways will pass 9 percent of the Probable Maximum Flood (PMF). The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief of Engineers, require that the structure (small size with high downstream hazard potential) pass 50 to 100 percent of the PMF, without overtopping. Considering the height of the dam (23 ft) and the small volume of water impounded (146 ac-ft), 50 percent of the PMF has been determined to be the appropriate spillway design flood.

The routing of 50 percent of the PMF through the spillways and dam indicates that the dam will be overtopped by 2.33 ft at elevation 725.83. The duration of the overtopping will be 6.83 hours, and the maximum outflow will be 4875 c.f.s. The maximum discharge capacity of the combined spillways is 283 c.f.s.

The 100-yr flood and the 10-yr flood were also routed through the spillways and dam. The result indicated that the 100-yr flood will overtop the dam by 0.60 ft at elevation

724.10 and that the duration of the overtopping will be 1.17 hours. The 10-yr flood will not overtop the dam. The computer input, output and hydrograph for 50 percent of the PMF are presented on Sheets 6, 7 and 8 of Appendix C.

OVERTOPPING ANALYSIS FOR LAKE JEANO DAM

INPUT PARAMETERS

1. Unit Hydrograph - SCS Dimensionless - Flood Hydrograph Package (HEC-1); Dam Safety Version Was Used.
   Hydraulic Inputs Are As Follows:

   a. Twenty-four Hour Rainfall of 27.1 Inches For 200 Square Miles - All Season Envelope

   b. Drainage Area = 562 Acres; = 0.88 Sq. Miles

   c. Travel Time of Runoff 0.33 Hrs.; Lag Time 0.20 Hrs.

   d. Soil Conservation Service Soil Group C

   e. Soil Conservation Service Runoff Curve No. 82 (AMC III)
      No. 65 (AMC II)

   f. Proportion of Drainage Basin Impervious 0.03

2. Spillways

   a. Primary Spillway: 24 in. I.D. CMP (Riser) and
      18 in. I.D. CMP (Outlet Pipe)

   b. Emergency Spillway: Trapezoidal Channel
      Length 16 Ft.; Side Slopes Vary; C = Varies

   c. Dam Overflow
      Length 450 Ft.; Crest El. 723.5 ; C = Varies

3. Spillway and Dam Rating:

   Curve Prepared by Hanson Engineers. Data Provided To Computer on Y4 and Y5 Cards. (see Sheet 5, Appendix C)
   Formula and Method:
   a) Primary Spillway: Charts for entrance and outlet control for CMP pipes.

   b) Emergency Spillway and Dam: $\frac{Q^2}{g} = \frac{A^3}{T}$

Note: Time of Concentration From Equation $Tc = \left(\frac{11.9\ L^3}{H}\right)^{.385}$

California Culvert Practice, California Highways and Public Works, Sept. 1942.

SUMMARY OF DAM SAFETY ANALYSIS

1. Unit Hydrograph

   a. Peak - 1775 c.f.s.

   b. Time to Peak 14 Min.

2. Flood Routings Were Computed by the Modified Puls Method

   a. Peak Inflow

      50% PMF 5294 c.f.s.; 100% PMF 10,588 c.f.s.

   b. Peak Elevation

      50% PMF 725.83 100% PMF 727.27

   c. Portion of PMF That Will Reach Top of Dam

      9 %; Top of Dam Elev. 723.50 Ft.

3. Computer Input and Output Data are shown on Sheets 5 and 6 of this Appendix.

```
A       OVERTOPPING ANALYSIS FOR JEANO DAM ( # 28 )
A       STATE ID NO. 30018  CO. NO. 223  CO. NAME WAYNE
A       HANSON ENGINEERS INC. DAM SAFETY INSPECTION JOB # 79511
B    300                5
B1     5
J      1        9        1
J1   .05      .10      .15      .20      .30      .40      .50      .75      1.0
K      0        1                                  3        1
K1      INFLOW HYDROGRAPH COMPUTATION **
M      1        2     0.88              0.88        1                          1
P      0     27.1      102      120      130
T                                                              -1      -82              0.03
W2  0.33     0.20
X      0     -.1        2
K      1        2                           0        4        1
K1      RESERVOIR ROUTING BY MODIFIED PULS AT DAM SITE **
Y                                     1        1
Y1     1                                                      81       -1
Y4 719.6    720.6    721.2    722.0    723.5    724.0    724.5    725.0    725.5    726.5
Y5     0       11       21       72      283      573     1104     2144     3534     7095
$A     0     13.8     19.5     43.0
$E 702.0    719.6    723.5    740.0
$$ 719.6
$D 723.5
K     99
```

P.M.F. Input Data
Sheet 6, Appendix C

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 9
				0.05	0.10	0.15	0.20	0.30	0.40	0.50	1.00
HYDROGRAPH AT	1	0.88	1	529.	1059.	1588.	2118.	3176.	4235.	5294.	10588.
	(	2.28)	(	14.99)(	29.98)(	44.97)(	59.96)(	89.95)(	119.93)(	149.91)(	299.83)
ROUTED TO	2	0.88	1	132.	469.	1070.	1685.	2783.	3982.	4875.	9640.
	(	2.28)	(	3.73)(	13.28)(	30.29)(	47.71)(	78.81)(	112.75)(	138.04)(	272.98)

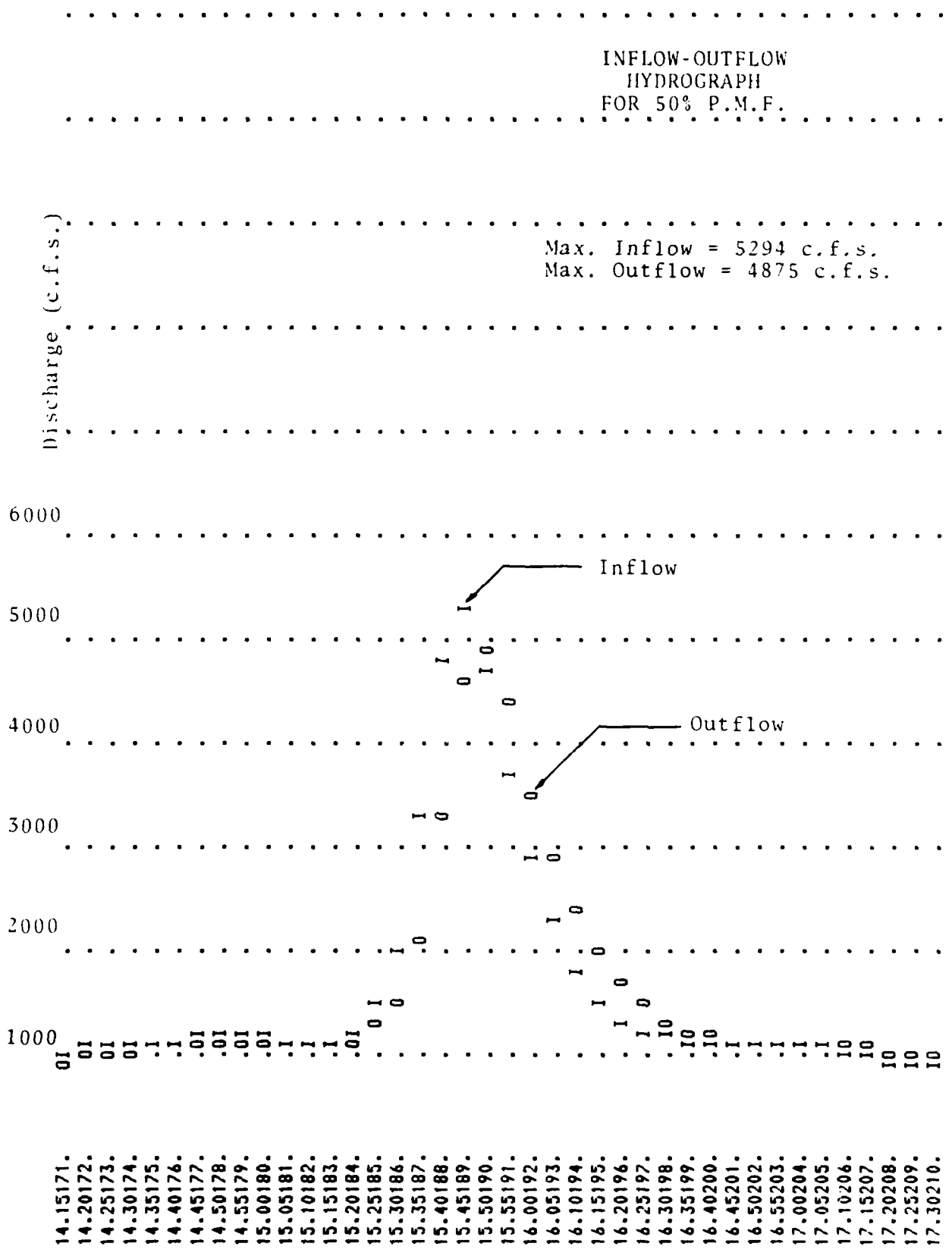
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	719.60	719.60	723.50
STORAGE	81.	81.	146.
OUTFLOW	0.	0.	283.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.05	722.42	0.00	126.	132.	0.00	16.33	0.00
0.10	723.82	0.32	152.	469.	1.00	16.08	0.00
0.15	724.47	0.97	165.	1070.	2.33	15.92	0.00
0.20	724.78	1.28	171.	1685.	3.83	15.83	0.00
0.30	725.23	1.73	181.	2783.	5.42	15.83	0.00
0.40	725.56	2.06	188.	3982.	6.33	15.83	0.00
0.50	725.83	2.33	194.	4875.	6.83	15.83	0.00
0.75	726.55	3.05	211.	7264.	7.92	15.83	0.00
1.00	727.27	3.77	228.	9640.	10.58	15.83	0.00

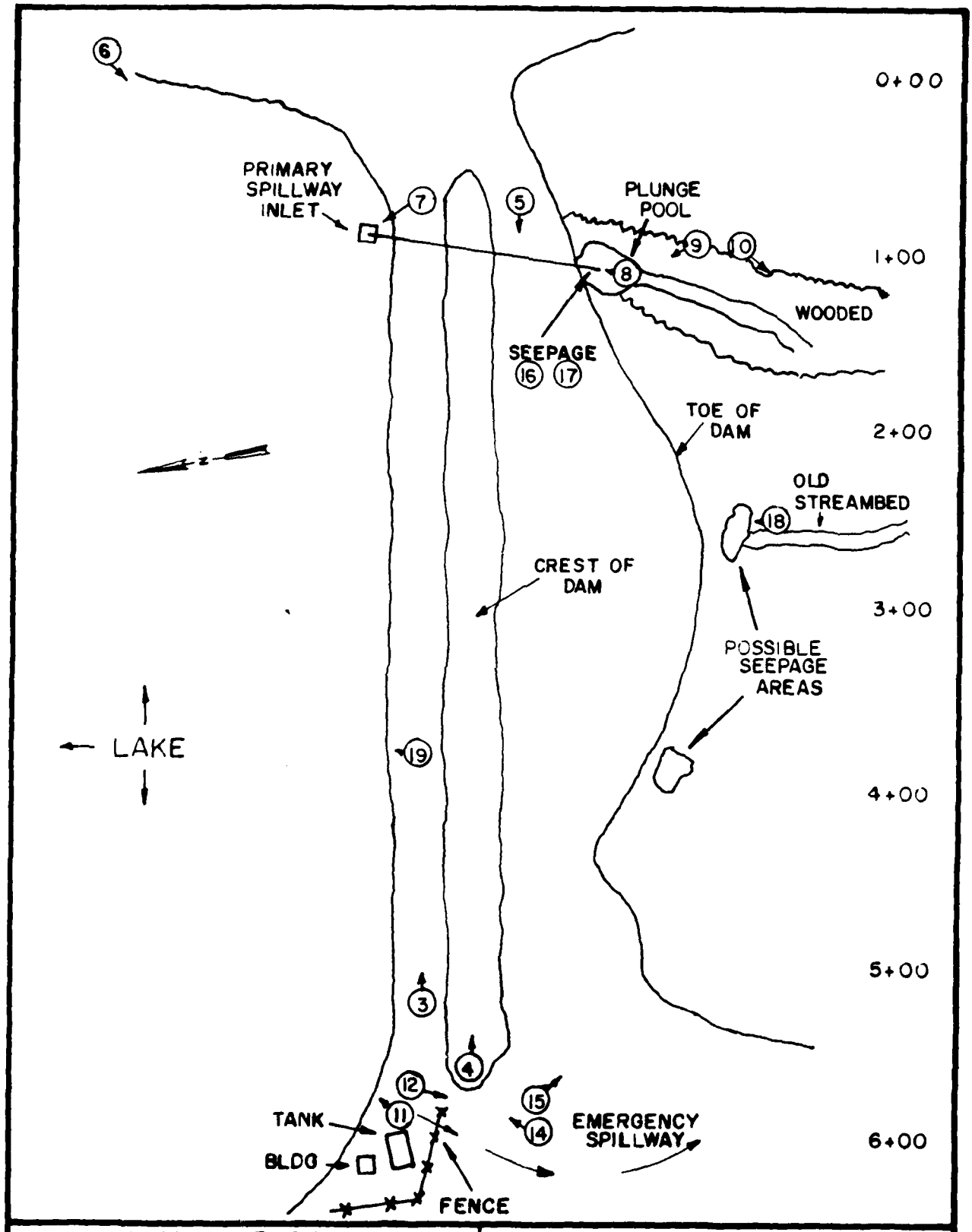
P.M.F. Output Data
Sheet 7, Appendix C


INFLOW-OUTFLOW
HYDROGRAPH
FOR 50% P.M.F.
Max. Inflow = 5294 c.f.s.
Max. Outflow = 4875 c.f.s.
Discharge (c.f.s.)
6000
5000
4000
3000
2000
1000
Inflow
Outflow
Time (hrs.)

APPENDIX D

INDEX TO PHOTOGRAPHS

Photo No.	Description
1	Aerial - Lake and Dam, Looking Northeast
2	Aerial - Lake and Dam, Looking East
3	Upstream Face of Dam, Looking East
4	Crest of Dam, Looking East
5	Downstream Face of Dam, Looking West
6	Primary Spillway Intake Area
7	Primary Spillway Inlet
8	Primary Spillway Outlet
9	Primary Spillway Outlet and Plunge Pool
10	Primary Spillway Discharge Channel
11	Emergency Spillway Approach Area, Looking Upstream
12	Emergency Spillway Approach Area, Looking Downstream
13	Emergency Spillway, Looking Downstream
14	Emergency Spillway, Looking Upstream
15	Emergency Spillway Discharge Channel
16	Seepage Beneath Primary Spillway Outlet
17	Seepage at Side of Plunge Pool
18	Possible Seepage Area at Station 2+75
19	View of Lake and Watershed



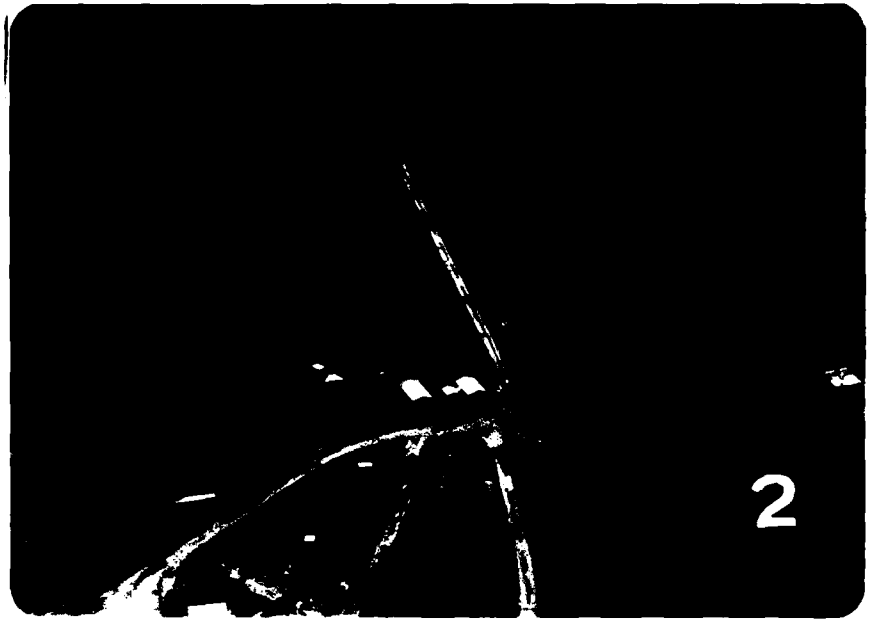
PLAN SKETCH

HANSON ENGINEERS

SPRINGFIELD ILL. PEORIA ILL.

LAKE JEANO DAM
MO. I.D. NO. 30018

SHEET 2 APPENDIX D

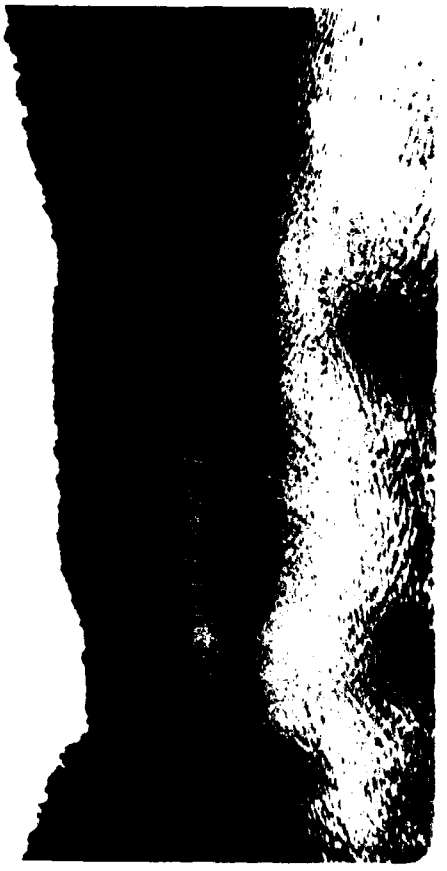

2


4


10


11


12




ED
8